

**FINAL
FIELD SAMPLING PLAN FOR
AREA 4**

**OF THE
CAMP EDWARDS IMPACT AREA
GROUNDWATER QUALITY STUDY**

**MASSACHUSETTS MILITARY RESERVATION
CAPE COD, MASSACHUSETTS**

Prepared for

**NATIONAL GUARD BUREAU
ARLINGTON, VIRGINIA**

Prepared by

**OGDEN ENVIRONMENTAL AND ENERGY SERVICES
239 Littleton Road, Suite 1B
Westford, Massachusetts 01886**



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Final FSP Area 4



DISCLAIMER:

This document has been prepared pursuant to a government administrative order (U.S. EPA Region I SDWA Docket No. I-97-1019) and is subject to approval by the U.S. Environmental Protection Agency. The opinions, findings, and conclusions expressed are those of the authors and not necessarily those of the Environmental Protection Agency.

A.6 Area 4 Field Sampling Plan

A.6.1 Background and Focal Area(s)

Area 4 is located on Tank Alley, as indicated in Figure A.6-1. Area 4 consists of two earthen mounds located just north of Tank Alley where it turns toward the south as seen in aerial photographs from 1963 to 1991 and Figure A.6-2. These mounds appear to be backstops for targets that were fired upon from the J-1 ranges located to the southeast. The mounds are located at the end of the 2000-meter range for J-1, based on a schematic diagram of J-1 ranges (see Area 5 FSP). No targets other than tanks are visible in this area. The mounds are a focal area.

Additionally, the topographic depression located adjacent to the Tank Alley Road is a focal area. A 1971 aerial photograph indicated that liquid was visible in this depression after significant rain. Based on interviews, depleted uranium (DU) rounds may have been used by R&D contractors in the J-1 range in the past because DU is extremely dense and provides high penetration. Depleted uranium contains 99.7% U_{238} , primarily an alpha emitter, and 0.3% U_{235} , a naturally occurring or enriched high-energy gamma emitter. If DU rounds were used in the past there may be alpha and low energy beta-gamma radiation present in the area, due to fracturing of the DU material.

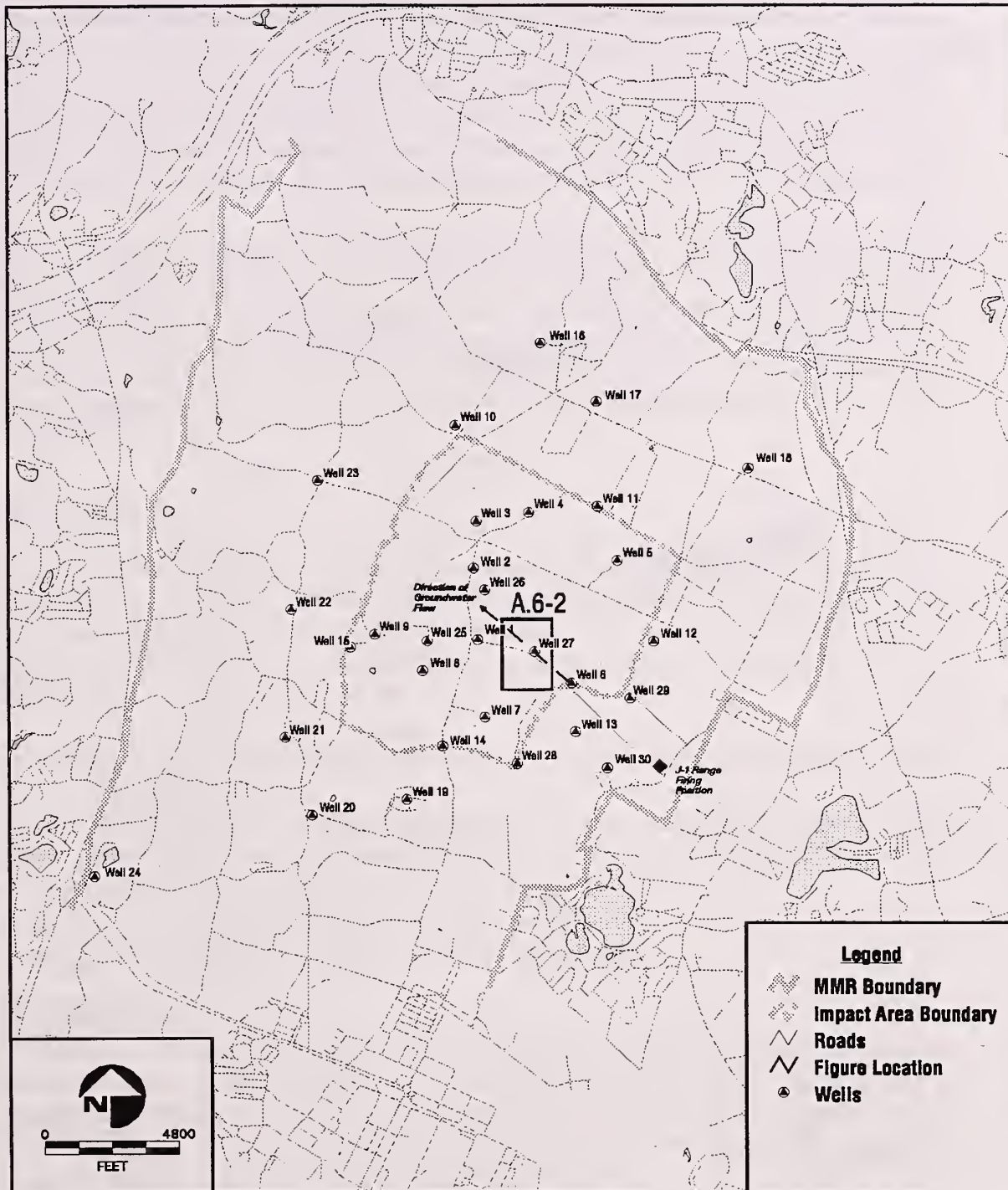
Two focal areas are identified for Area 4, as indicated in Figure A.6-2:

- the 120x70-foot mound, closest to the road, with an estimated area of 0.2 acres and the 270x100-foot mound, north of the road and the smaller mound, with an estimated area of 0.6 acres; and
- the topographic depression south of Tank Alley Road and in the vicinity of the mounds with an estimated area of 0.1 acre.

A.6.2 Sampling & Analysis Methods

Area 4 sampling will include surface soil at each of the focal areas. Sampling grids for the mounds will be located at the top of each mound, at the toe of the slope facing the firing positions, and between the mounds, since these locations are potential areas for contaminants to collect via atmospheric deposition or surface water runoff. Grid positions are indicated in Figure

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MMR - Area 4 Vicinity Map

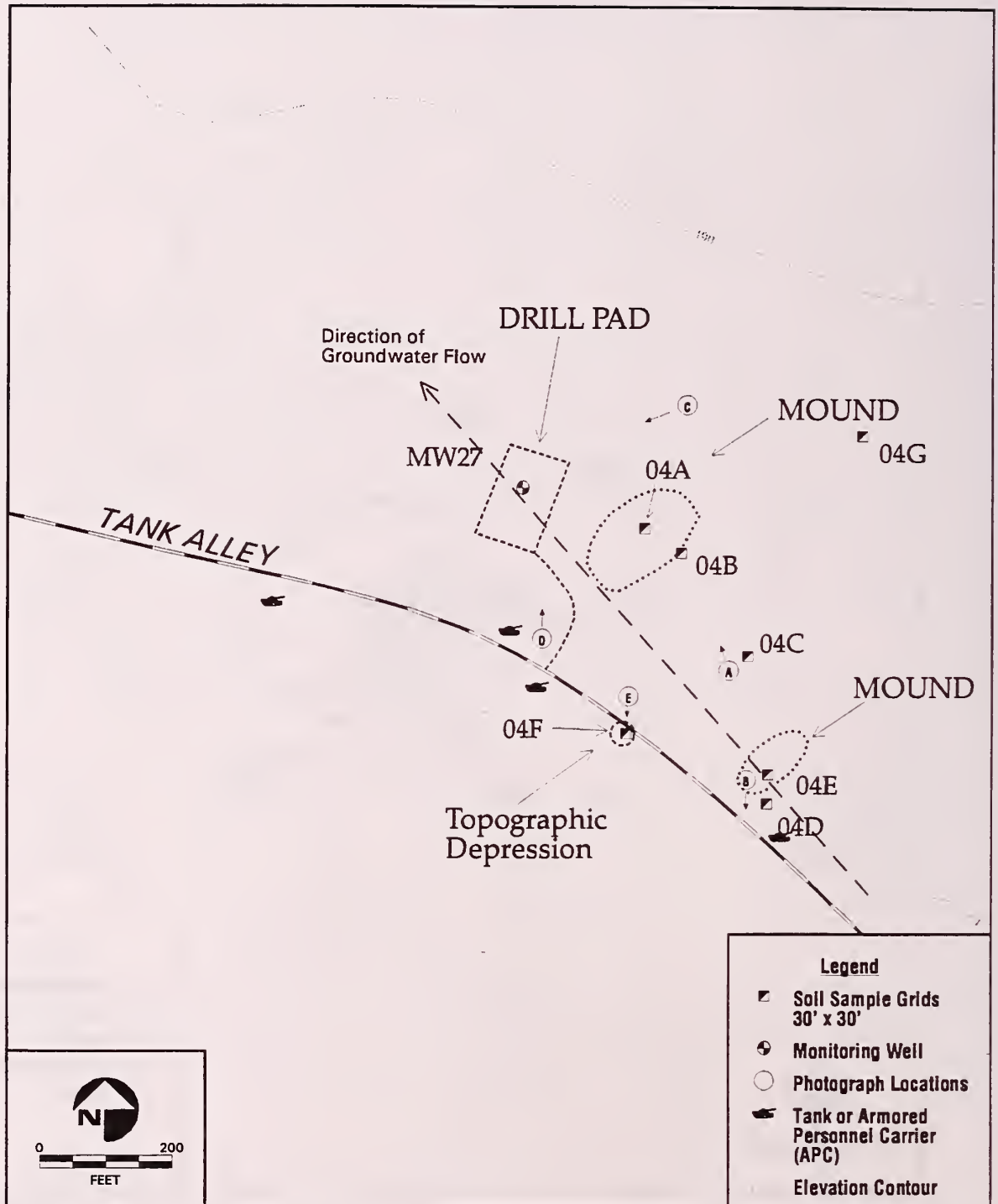
FIGURE

A.6-1

/soro/utrcmd/plot/figures/ae/ae4_vmap.xml

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Area 4 Sampling Points

FIGURE

A.6-2

/sorel/numa/plot/figures/fig_a62.amd

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A.6-2. Note that grid 04D has been moved slightly south from the line of fire to the southeast, in order to better measure impacts from the firing on the tank target in this area. The positioning of this downgradient sample location is consistent with the USGS groundwater model of Western Cape Cod. One position will be located northeast of the northern mound to evaluate the potential for contaminants in this general area, away from the backstops. All 0-6" and 18-24" samples will be collected in locations undisturbed by excavation or road building activities. Area 4 sampling will also include subsurface soil and groundwater hydraulically downgradient of the two mounds based on the potential for contaminants to migrate into deeper soils or groundwater.

Sample collection will be consistent with MMR SOPs, the Ogden Health and Safety Guidelines, Attachment A: Field Guide to High Explosives, and the EPA Standard Guide for Composite Sampling and Field Subsampling for Environmental Waste Management Activities (October 31, 1996). Area 4 is within the Impact Area, therefore all samples with detectable levels of explosives by the colorimetric analysis will be analyzed by EPA Method 8330. **All borings and hand auger locations in Area 1 are subject to UXO clearance requirements.**

Radiological Survey

A radiological survey of soil samples will be conducted at all soil sampling locations in the J-1 ranges based on their potential to contain alpha and low energy beta-gamma radiation. All three types of radiation can be detected with the portable radiation instruments, which will be used during soil sampling activities. The survey will be conducted according to the following procedures:

1. the portable survey meter will be calibrated at annual intervals and will be properly labeled with the calibration date;
2. the portable survey meters will be checked for response with an appropriate radiation source;
3. background radiation levels will be determined prior to sampling activities;
4. the response check will be repeated periodically during the survey;
5. all readings will be taken within 1cm of the soil sample;
6. all results will be recorded in disintegrations per minute (dpm).

Hand Augering Grids

A representative portion of each focal area will be sampled, as indicated in Figure A.6-2. The mounded focal areas will have five grids. One grid will be located on top of and one grid to the east or southwest of each of the mounds, and one grid will be located between the mounds as seen in Figure A.6-2. One grid will be used to sample the topographic depression. One grid will be used to sample "local background" conditions to the north.

Each soil boring grid will consist of nine sample points spaced ten feet apart as illustrated in Figure A.6-3. The following protocol will be followed for hand augering:

1. a 0-6" soil sample will be collected from each of the nine sample points in a grid;

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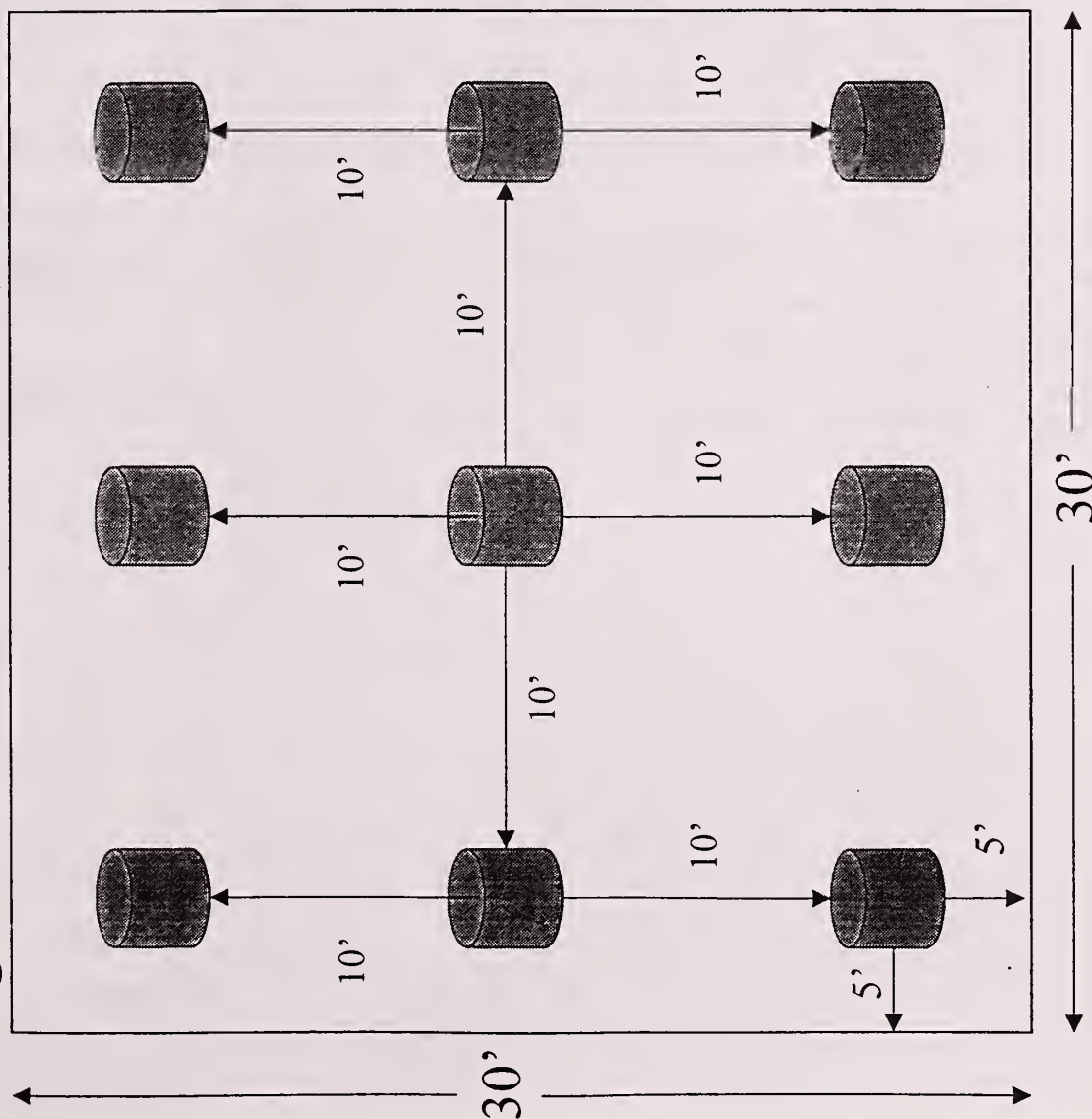
2. soil from each sample point will be placed in a headspace jar;
3. the remaining soil from each of the nine sample points will be composited in accordance with Section 8.1 of the EPA Standard Guide and Attachment A of this FSP;
4. headspace measurements will be collected from each of the nine 0-6" samples and recorded in the space provided on the hand auger log;
5. a VOC grab sample will be collected from one sample point based on the following priority of observations: 1) highest response on the FID, 2) visual signs of contamination, 3) the central grid location (a fresh soil sample will be collected adjacent to the sample point). The VOC sample will be collected from within one-foot of the FID screening sample;
6. the 0-6" composite sample will be submitted for explosives, inorganics, and other analytes;
7. when the analytical results from the 0-6" sample are available, an 18-24" sample will be collected and composited as described above for explosives and inorganics. Any other analytes (except VOC) that are detected in the 0-6" sample will be analyzed;
8. an 18-24" sample will be selected for VOC analysis based on screening with an FID as described in steps 1-5 above.

Barber Rig Drilling

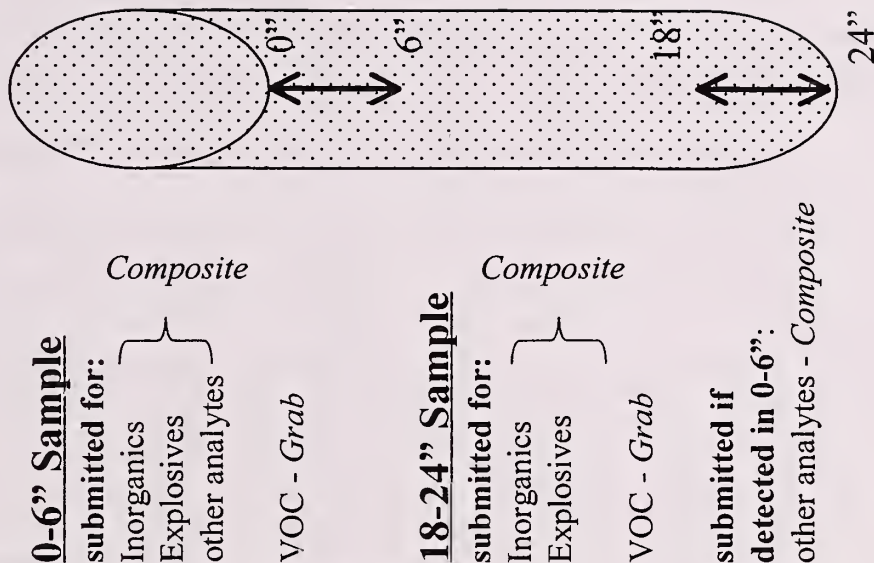
A boring will be advanced to the water table at the location indicated in Figure A.6-1, and completed as a shallow monitoring well, MW27. This boring will be completed using a Barber Rig. The boring will be placed at the western end of focal area 2, the larger mound.

Prior to the onset of the investigation, the site will be intrusively cleared of UXO to a depth of two feet below grade. Additional clearance will occur from a depth of two feet to 10 feet below grade. Under this procedure, a down-hole magnetometer will be lowered into the hole prior to advancing the auger in two-foot intervals. After completion of the next two-foot interval, 4" PVC will be inserted into the borehole and the rig will be moved off of the hole prior to magnetic survey of the next interval. The boring location will be considered clear when a depth of ten feet is reached without encountering any magnetic anomalies (clearance to 12 feet).

Figure A.6-3: Plan of Soil Sampling Grid:



Soil Sampling Point:



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The following protocol will be used for drilling with a barber rig (every soil sample with explosives detected by the colorimetric method will also be analyzed by Method 8330):

1. A 0-6" sample will be collected and submitted for explosives, inorganics, and all other analytes;
2. From ten feet below grade until the water table is encountered, a soil sample will be collected every ten feet using a split spoon;
3. The 10-12' interval will be FID screened and submitted for explosives, inorganics, and other analytes;
4. The 20-22' interval will be FID screened and submitted for explosives, and inorganics;
5. Each sample below the 20-22' interval will be screened with an FID and sampled for explosives (submitted ON HOLD) and inorganic analysis;
6. The soil samples submitted ON HOLD for explosives will be analyzed only if explosives are detected in the 10-12' or 20-22' sample interval; and
7. Each sample below the 20-22' interval will be sampled for the other analytes only if there is a response on the FID.
8. An 18-24" sample will be collected for explosives and inorganics analysis when the 0-6" sample results are received.
9. An 18-24" sample will be collected for any other analytes detected in the 0-6" sample.

From the water table to the completion of the boring, soil will be sampled from the cyclone for lithology. Groundwater samples will be collected at every ten feet during advancement of the borings and will be submitted for laboratory analysis of explosives and VOCs. Wells will be screened as described in Section 4.2.2 of the Action Plan.

Table A.6-1 lists sample numbers and analytical requirements for the areas to be investigated.

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MMR Soil Samples from Hand Auger Grids						Parameters:	Explosives (colorimetric)	Explosives (EPA 8330)	Inorganics	Other Analytes:	VOC	SVOC	PCB/Pest.	Herbicide	EDB	MTBE	
Area	Grid	Depth	Type	MMR ID	EPA/Ogden ID	Cont:	8oz	8oz	8oz		4 oz.	8 oz.			4 oz. *		
4	04A	0-6	grab	71BS04AXAX01XA	B04AAA						X						
			comp	71BS04AXAX01XA	B04AAA		X		X			X	X	X	X	X	
		18-24	grab	71BS04AXBX01XA	B04ABA						#						
			comp	71BS04AXBX01XA	B04ABA		O		O			#	#	#	#	#	#
	04B	0-6	grab	71BS04BXAX01XA	B04BAA						X						
			comp	71BS04BXAX01XA	B04BAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04BXX01XA	B04BBA						#						
			comp	71BS04BXX01XA	B04BBA		O		O			#	#	#	#	#	#
	04C	0-6	grab	71BS04CXAX01XA	B04CAA							X					
			comp	71BS04CXAX01XA	B04CAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04CXX01XA	B04CBA						#						
			comp	71BS04CXX01XA	B04CBA		O		O			#	#	#	#	#	#
	04D	0-6	grab	71BS04DXAX01XA	B04DAA							X					
			comp	71BS04DXAX01XA	B04DAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04DXX01XA	B04DBA						#						
			comp	71BS04DXX01XA	B04DBA		O		O			#	#	#	#	#	#
	04E	0-6	grab	71BS04EXAX01XA	B04EAA							X					
			comp	71BS04EXAX01XA	B04EAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04EXBX01XA	B04EBA						#						
			comp	71BS04EXBX01XA	B04EBA		O		O			#	#	#	#	#	#
	04F	0-6	grab	71BS04FXAX01XA	B04FAA							X					
			comp	71BS04FXAX01XA	B04FAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04FXBX01XA	B04FBA						#						
			comp	71BS04FXBX01XA	B04FBA		O		O			#	#	#	#	#	#
	04G	0-6	grab	71BS04GXAX01XA	B04GAA							X					
			comp	71BS04GXAX01XA	B04GAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04GXX01XA	B04GBA						#						
			comp	71BS04GXX01XA	B04GBA		O		O			#	#	#	#	#	#
	04H	0-6	grab	71BS04HXAX01XA	B04HAA							X					
			comp	71BS04HXAX01XA	B04HAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04HXX01XA	B04HBA						#						
			comp	71BS04HXX01XA	B04HBA		O		O			#	#	#	#	#	#
	04I	0-6	grab	71BS04IXAX01XA	B04IAA							X					
			comp	71BS04IXAX01XA	B04IAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04IXBX01XA	B04IBA						#						
			comp	71BS04IXBX01XA	B04IBA		O		O			#	#	#	#	#	#
	04J	0-6	grab	71BS04JXAX01XA	B04JAA							X					
			comp	71BS04JXAX01XA	B04JAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04JXX01XA	B04JBA						#						
			comp	71BS04JXX01XA	B04JBA		O		O			#	#	#	#	#	#
	04K	0-6	grab	71BS04KXAX01XA	B04KAA							X					
			comp	71BS04KXAX01XA	B04KAA		X		X			X	X	X	X	X	X
		18-24	grab	71BS04KXX01XA	B04KBA						#						
			comp	71BS04KXX01XA	B04KBA		O		O			#	#	#	#	#	#
X = to be collected and submitted to laboratory																	
O = to be collected when results from the 0-6" sample are available																	
# = to be collected if detected in the 0-6" sample																	

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MMR Subsurface Soil Samples from Borings					Parameters:	Explosives (colorimetric)	Explosives (EPA 8330)	Inorganics	Other Analytes:	VOC	SVOC	PCB/Pest.	Herbicide	EDB	MTBE	
Area	Loc.	Depth	MMR ID	EPA/Ogden ID	Cont.	8oz	8oz	8oz		4oz	8 oz.			4oz		
4	MW27	A(0-6")	71MS27DXAX01XA	S27DAA		X		X		X	X	X	X	X	X	
		B(18-24")	71MS27DXBX01XA	S27DBA		@		@		@	@	@	@	@	@	
		C(10-12')	71MS27DXCX01XA	S27DCA		X		X		X	X	X	X	X	X	
		D(20-22')	71MS27DXDX01XA	S27DDA		X		X		*	*	*	*	*	*	
		E	71MS27DXEX01XA	S27DEA		X		X		*	*	*	*	*	*	
		F	71MS27DXFX01XA	S27DFA		X		X		*	*	*	*	*	*	
		G	71MS27DXGX01XA	S27DGA		X		X		*	*	*	*	*	*	
		H	71MS27DXHX01XA	S27DHA		X		X		*	*	*	*	*	*	
		I	71MS27DXIX01XA	S27DIA		X		X		*	*	*	*	*	*	
		J	71MS27DXJX01XA	S27DJA		X		X		*	*	*	*	*	*	
		K	71MS27DXKX01XA	S27DKA		X		X		*	*	*	*	*	*	
		L	71MS27DXLX01XA	S27DLA		X		X		*	*	*	*	*	*	
		M	71MS27DXMX01XA	S27DMA		X		X		*	*	*	*	*	*	
X - collect and submit																
X - collect and submit ON HOLD																
@ - to be sampled after results from the 0-6" sample are received																
@ - to be sampled if detected in the 0-6" sample																
* - collect and submit only if there is an FID response.																



Photograph A: Looking northwest toward northern mound from top of southern mound.



Photograph B: Looking southeast down tank alley from top of southern mound.



Photograph C: Looking west toward Turpentine Road from northeast side of northern mound.



Photograph D: Looking north toward northern mound from Tank Alley.



Photograph E: Low area on southern side of Area 4 looking south from Tank Alley.

ATTACHMENT A: FIELD GUIDE TO HIGH EXPLOSIVES

Any substance encountered during sampling activities which differs in any way from natural media will be treated as a dangerous substance, carefully removed from the sample, and set aside.

EXPLOSIVES

<u>NAME</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
BLACK POWDER	BROWN TO BLACK	MANUFACTURED IN GRAINS THAT RANGE IN SIZE FROM SMALLER THAN SALT GRAINS TO GRAINS AS LARGE AS SMALL PEBBLES. HIGHLY SENSITIVE TO IGNITION BY HEAT, FRICTION, FLAME, SPARK. WHEN WET, IT IS CORROSIVE TO MOST METALS.
TNT	LIGHT YELLOW TO BROWN OR GRAY	LIGHTLY CORROSIVE WITH LEAD. USED IN BOMBS, GRENADES, DEMOLITION CHARGES, PROJECTILES. EXUDES AT ELEVATED TEMPERATURES. MODERATELY TOXIC BY SKIN ABSORPTION OR INHALATION.
EXPLOSIVE D	BRIGHT YELLOW TO ORANGE. ALSO CALLED AMMONIUM PICRATE.	RELATIVELY INSENSITIVE. HIGHLY TOXIC BY INHALATION, INGESTION, OR SKIN ABSORPTION
AMATOL	LIGHT BROWN TO YELLOW/MIXTURE OF TNT AND EXPLOSIVE D	SLIGHT HYGROSCOPIC. HAS CORROSIVE EFFECTS ON COPPER, BRONZE, LEAD, BRASS. HIGHLY TOXIC BY INHALATION, SKIN CONTACT, INGESTION.
COMPOSITION B	WHITE TO BROWNISH YELLOW, MIXTURE OF TNT AND EXPLOSIVE D	SLIGHTLY CORRODES COPPER, BRASS, CADMIUM, ZINC. USED IN BOMBS, PROJECTILES, GRENADES, SHAPED CHARGES.
OCTOL	LIGHT BROWN	USED IN BOMBS, PROJECTILES, SHAPED CHARGES.
RDX	WHITE. ALSO CALLED CYCLONITE	SENSITIVE TO IMPACT AND FRICTION. SLIGHTLY CORROSIVE WITH COPPER, BRASS, MILD STEEL, CADMIUM. MODERATELY TOXIC BY INHALATION OR INGESTION.
HMX	WHITE. ALSO CALLED OCTOGEN	SENSITIVE TO IMPACT AND FRICTION. SLIGHTLY TOXIC.
PETN	WHITE	SENSITIVE TO IMPACT. SLIGHTLY CORROSIVE TO BRASS, CADMIUM, ZINC. VERY SLIGHTLY TOXIC.

EXPLOSIVES, continued

<u>NAME</u>	<u>DESCRIPTION</u>	<u>REMARKS</u>
LEAD AZIDE	WHITE TO LIGHT BROWN	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO COPPER. ZINC. VERY SLIGHTLY TOXIC.
LEAD STYPHNATE	LIGHT ORANGE TO REDDISH BROWN	SAME AS LEAD AZIDE.
MERCURY FULMINATE	GRAYISH	VERY SENSITIVE TO IMPACT, FRICTION, SPARKS. CORROSIVE TO ALUMINUM, MAGNESIUM, BRONZE, COPPER, ZINC, BRASS. HIGHLY TOXIC THROUGH SKIN ABSORPTION, INHALATION, INGESTION. SYMPTOMS RESEMBLE MERCURY POISONING.

PYROTECHNIC AGENTS USED AT MMR

<u>SYMBOL</u>	<u>COMMON NAME</u>	<u>VISUAL IDENTIFICATION</u>	<u>ACTION</u>
CS	NONE	WHITE CRYSTALLINE SOLID	TEAR AGENT
HC	HEXACHORO-ETHANE	WHITE SOLID	SCREENING SMOKE
WP	WHITE PHOSPHOROUS	PALE YELLOW SOLID	SCREEN SMOKE AND INCENDIARY
RP	RED PHOSPHOROUS	REDDISH BROWN POWDER	SCREENING SMOKE

OTHER COMPOUNDS

<u>NAME</u>	<u>PROPERTIES</u>	<u>STABILITY</u>
Picric Acid	lemon-yellow crystalline solid	very sensitive to blows or friction
Tetryl	fine yellow crystalline powder	sensitive to blows or friction
Composition A	unknown	unknown
Composition C3	unknown	unknown
Composition C4	unknown	unknown
Pentolite (50/50)	unknown	unknown
Tracer Compound	unknown	unknown
PBX	unknown	unknown
Ednatol	unknown	unknown
Tetrytol	unknown	unknown

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